

Concordia University
Dept. of Computer Science & Software Engineering
Comp 353- Databases
Summer 2023

Main Project

Title: A Simple database Application System for the education health facilities

Reports Due: Wednesday August 9th, 2023, before 12:00 noon.

Demos: On August 10th, and 11th.

Maximum Mark: 12%

Project Description

This system builds on and extends the application developed in the warm-up project. It adds some new functionalities and requires a Graphical User Interface to facilitate user interaction with the system.

In the main project, you developed a database system called Education Personnel Status Tracking System (EPSTS). The system is developed for the education health facilities to help the ministry of education to keep track of all the personnel's health status during the COVID-19 pandemic. The system should maintain all the information that is related to the pandemic about the employees of the ministry and the students who are getting education within the ministry.

Information includes infection(s) of every person, date of infection and nature of infection. The person could be infected more than once. Every time a person is infected, the application needs to store the date of the infection, and the type of infection. The infection type could be COVID-19, SARS-Cov-2 Variant, or other types of infection.

Also, information about the vaccination of every person including for every vaccination, the vaccination date, the type of vaccination, and the dose number of the vaccination. The type of vaccinations could be Pfizer, Moderna, AstraZeneca, Johnson & Johnson, etc. Also, the dose number could be 1, 2, or more. For example: Alfred McDonald could have taken the first vaccination dose Pfizer on the 20th of January 2021, and the second vaccination dose Moderna on the 25th of April 2022.

The information maintained by the system is used to help the ministry to keep track of their employees and their students' health status to reduce the risk of contamination between the people within the ministry's different facilities.

Each ministry operates different facilities. Each facility could include name, address, city, province, postal-code, phone number, web address, capacity (Maximum number of employees that the facility needs to operate). A facility could be a management facility or could be an educational facility.

A management facility could be a head office facility or a general management facility. A management facility could be operated by different employees. Each management facility has one president, many secretaries, many specialized personnels, and many other employees such as security personnel, or any other personnel working for the facility. Each ministry has only one head office facility. The president of the head office is the minister of education of the ministry.

An educational facility could be a primary school, a middle school, a high school, or a combination of any of the three schools. An educational facility could be operated by different employees and have many students. Each educational facility has one principle and many employees.

The application must maintain information about every employee working in each facility and every student registered in each educational facility. The information includes first-name, last-name, date of birth, Medicare card number, Medicare expiry date, telephone-number, address, city, province, postal-code, citizenship, and email address.

An employee could be a teacher, administrative personnel, or any other personnel working for the facility. A teacher could be an elementary teacher, or a secondary teacher. A secondary teacher can be specialized in one subject and can work as school counselor, program director, and school administrator.

Every employee and every student must be registered with the public health care system which means that the Medicare card number cannot have null value. No two people can have the same Medicare card number.

An employee can work at only one facility at the same time. An employee can work at different facilities at different times. For every employee, the start date and end date working at each facility must be maintained. If the end date is null, it indicates that the employee is still working at the facility. An employee can work at the same facility at different intervals of times. For example, Roger Smith who is a teacher could have worked at Rosemont Elementary School from Jan 15th, 2022, to September 15th, 2022, then worked at Laval Secondary School from September 16th, 2022, to February 15th 2023 and then worked at Rosemont Elementary School from February 16th 2023 till now.

A student can be registered at only one educational facility at the same time. A student can be registered at different educational facilities at different times. For every student, the start date and end date registered at each facility must be maintained. If the end date is null, it indicates that the student is still registered at the facility. The current level of every student must be maintained by the system. For example, a student is currently in elementary 3 or in secondary 2, etc.

The schedule of every employee at each facility is maintained by the system. For every facility, and for every employee working in the facility, the schedule includes the date, the start time, and the end. Start time cannot be greater than the end time. An employee cannot be scheduled at two different conflicting times neither at the same facility nor at different facilities. If an employee is scheduled for two different periods on the same day

either at the same facility or at different facilities, then at least one hour should be the duration between the first schedule and the second one. The history of the schedules is maintained by the system. A schedule of four weeks ahead of time is supported by the system. If a teacher is infected by COVID-19, then he/she cannot be scheduled to work for at least two weeks from the date of infection. An employee cannot be scheduled if she/he is not vaccinated, at least one vaccine for COVID-19 in the past six months prior to the date of the new schedule.

If a teacher gets infected by COVID-19, then the system should automatically cancel all the assignments for the infected teacher for two weeks from the date of infection. Also, the system should send an email to inform the principal of the school where the teacher has been infected. The email should have as a subject “Warning” and as a body example “Roger Brian who teaches in your school has been infected with COVID-19 on 24, Jan, 2023”.

On Sunday of every week, for every employee working in every facility, the system should automatically send an email to every employee indicating the schedule of the employee in the facility for the coming week. The subject of the email should include the facility name, and the dates covered by the schedule. A subject example: “St. Laurent Elementary School Schedule for Monday 20-Feb-2023 to Sunday 26-Feb-2023”. The email body should include the facility name, the address of the facility, the employee’s first-name, last-name, email address, and details of the schedule for the coming week. Details include the day of the week, start time and end time. The body of the message should also include an entry for every day of the week followed by the starting hour and end hour for that day. A message “No Assignment” is displayed if the employee is not scheduled for that specific entry.

A log table is stored in the database that contains information on every email generated by the system. The log includes date of the email, the sender of the email (name of the facility), the receiver of the email, the subject of the email, and the first 80 characters of the body of the email.

What you should do:

In the above, we provided the minimum requirements for this application. You could add more details if you find suitable and useful. Considering the information so far, do the following steps in your database design process:

1. Develop an E/R diagram to represent the conceptual database design for the above application.
2. In the diagram, mark, or express various constraints (keys, functional dependencies, cardinalities of the relationships, etc.) Identify any constraints that are not captured by the E/R diagram.

3. Convert your E/R diagram into a relational database schema. Make refinements to the DB schema if necessary. Identify various integrity constraints such as primary keys, foreign keys, functional dependencies, and referential constraints. Make sure that your database schema is at least in 3NF.
4. Are all your relations in the database in BCNF? (Explain which ones and why not)
5. For any relation in your database, if it is not in BCNF, then show that it is in 3NF.
6. Create at least one trigger to execute some of the requirements specified in the description above.

Formulate and evaluate the following SQL DDL and DML commands against your database in which every relation is populated with 'sufficient' representative tuples.

1. Create/Delete/Edit/Display a Facility (Ministry, School, etc.).
2. Create/Delete/Edit/Display a Student.
3. Create/Delete/Edit/Display an Employee.
4. Create/Delete/Edit/Display a Vaccination.
5. Create/Delete/Edit/Display an Infection.
6. Register/Modify registration/Cancel registration for a student in a school.
7. Assign/Delete/Edit schedule for an Employee. (Attempt to schedule a conflicting assignment for an employee)
8. Get details of all the facilities in the system. Details include the facility's name, address, city, province, postal-code, phone number, web address, type, capacity, president's/principle's first name, last name, and number of employees currently working for the facility. Results should be displayed sorted in ascending order by province, then by city, then by type, then by number of employees currently working for the facility.
9. Get details of all the employees currently working in a specific facility. Details include employee's first-name, last-name, start date of work, date of birth, Medicare card number, telephone-number, address, city, province, postal-code, citizenship, and email address. Results should be displayed sorted in ascending order by role, then by first name, then by last name.
10. For a given employee, get the details of all the schedules she/he has been scheduled during a specific period of time. Details include facility name, day of the year, start time and end time. Results should be displayed sorted in ascending order by facility name, then by day of the year, then by start time.
11. Get details of all the teachers who have been infected by COVID-19 in the past two weeks. Details include the teacher's first-name, last-name, date of infection, and the name of the facility that the teacher is currently teaching for. Results should be displayed sorted in ascending order by the facility name, then by the first name of the teacher.

12. List the emails generated by a given facility. The results should be displayed in ascending order by the date of the emails.
13. For a given facility, generate a list of all the teachers who have been on schedule to work in the last two weeks. The list should include first-name, last-name, and role (elementary/secondary). Results should be displayed in ascending order by role, then by first name.
14. For a given facility, give the total hours scheduled for every teacher during a specific period. Results should be displayed in ascending order by teacher's first name then last name.
15. For every high school, provide the province where the school is located, the school's name, the capacity of the school, and the total number of teachers in the school who have been infected by COVID-19 in the past two weeks, and the number of students in the school who have been infected by COVID-19 in the past two weeks. The results should be displayed in ascending order by province, then by the total number of teachers infected.
16. For every ministry in the system, provide the minister's first-name, last-name, the city of residence of the minister, and the total number of management facilities, and the total number of educational facilities that the minister is currently administering. Results should be displayed in ascending order by city, then in descending order by total number of schools.
17. Get details of the counselor(s) who are currently working and has been infected by COVID-19 at least three times. Details include first-name, last-name, first day of work as a teacher, role (elementary/secondary), date of birth, email address, and total number of hours scheduled. Results should be displayed sorted in ascending order by role, then by first name, then by last name.
18. You should show the trigger(s) used by your system. Explain the trigger(s) used and their benefits.
19. You need to demonstrate the integrity of all the requirements provided in the description. Example, the system should not allow a user to schedule an employee on two different conflicting time.
20. You need to demonstrate the generation of emails and the logs of the emails produced by the system.

What you should submit:

Your project report should include the E/R diagram, the DB-design, and its normalization (including the analysis of 3NF and BCNF), the SQL declarations of the relations, the implementation code, relation instances, and the SQL scripts for the queries and transactions, and 5 tuples of each query result. Build a useful web interface to facilitate interactions with the database application system. Also include in your report, a few snapshots of the user interface you developed. A schedule of time slots for the demos of your main project will be posted through the course Moodle in August which is assigned on a first come first served basis. All members of your team must be present during your project demo.